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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/824,310	04/13/2004	Junko Yotani	96790P453	5984

8791 7590 12/04/2007  
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EXAMINER
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STOUFFER, KELLY M

ART UNIT	PAPER NUMBER
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1792

MAIL DATE	DELIVERY MODE
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12/04/2007

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	Application No. 10/824,310	Applicant(s) YOTANI ET AL.	
	Examiner Kelly Stouffer	Art Unit 1792	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 18 October 2007.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-7 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-7 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)          | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Response to Arguments***

Applicant's arguments with respect to claims 1-7 have been considered but are moot in view of the new ground(s) of rejection.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-7 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The disclosure as written does not provide support for the claim 1 limitation "each of the entangled nanotube fibers having at least two ends connecting to the substrate". The disclosure on page 7 lines 3-7 (also cited for support for the amendments by the applicant in the instant arguments) provides support for one end connected to the surface of the substrate, not at least two ends connected to the surface of the substrate, as the claim present claim language suggests.

Further, the limitation of "wherein the step of irradiating includes the step of creating a plurality of curled nanotube fibers on the substrate from at least one of the entangled nanotube fibers by the laser beam" implies that the laser beam is curling the nanotube fibers when the specification only provides support for using the laser to disconnect the nanofibers from the substrate.

Claims 1-7 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Claim 1 includes the limitation "each of the entangled nanotube fibers having at least two ends connecting to the substrate". The breadth of the claim is specific in comparison to the disclosure, which does not describe this feature as discussed above. The state of the prior art indicates that if one wanted to attach a carbon nanofiber or nanotube to the substrate with both ends, one would need a catalyst on the substrate to grow the nanotube or nanofiber between (see Shin et al. US 2002/0003463 A1). The specification, in not describing a nanotube or nanofiber attached to a substrate with both ends, does not indicate how one of ordinary skill in the art would accomplish this, and does not mention a catalyst for this purpose. Because of the nature of the invention, that the carbon nanotubes may be grown using many ways included electrodeposition, thermal CVD, and spraying, it would be difficult for one of ordinary skill in the art (at a graduate school level or professional) to predict how to grow a nanotube or nanofiber in

the manner claimed, as a catalyst may not work in all situations, and there is no direction or support for this feature in the disclosure or no working examples showing this feature. Therefore, the quantity of experimentation required by one of ordinary skill in the art to make or use the invention based on the content of the disclosure is excessive.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-7 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The limitation of "entangled nanotube fibers having at least two ends" is deemed confusing because it is not certain how the nanotube fibers may have more than two ends after deposition which the phrase "at least" implies. It is uncertain whether this limitation is used to designate that the fibers may be branched.

Further, the limitation of "wherein the step of irradiating includes the step of creating a plurality of curled nanotube fibers on the substrate from at least one of the entangled nanotube fibers by the laser beam" implies that the laser beam is curling the nanotube fibers when it is only disconnecting them from the substrate. Therefore, this limitation is deemed confusing.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent publication 2001/0028209 to Uemura et al. in view of US Patent publication US

2002/0003463 to Shin et al and in further view of US Patent publication 2004/0095050 to Liu et al

Regarding claim 1, Uemura et al. includes a method of manufacturing an electron-emitting source (entire document) by forming a film containing curled and entangled nanotube fibers on a substrate (paragraph 0025). Uemura et al. desires the entangled fibers to be smoothed by an electric field so that the light emitting density of the phosphor screen caused by electron irradiation from the source becomes uniform (paragraph 0042). Uemura et al. does not include a carbon nanofiber connected to the substrate at both ends. Shin et al. teaches connected the nanofiber to a substrate at both ends using catalysts in order to fix the nanofibers at desired locations on the substrate (abstract) and to further control the deposition process (paragraph 0024). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Uemura et al. to include nanofibers with both ends attached to the substrate as taught by Shin et al. in order to exert more control over the deposition process. Uemura et al. and Shin et al. do not include smoothing the fibers by irradiation with a laser. Liu et al. teaches using a laser to irradiate the nanotubes perpendicular to the surface (paragraphs 0022-0024) to smooth the surface more than that of the method taught by Uemura et al. and also removes byproducts on the nanotube surface, further improving electron emission (paragraph 0024). Liu et al. uses the laser to remove nanotubes from the ends of other nanotubes on the substrate to remove catalyst byproducts and unwanted amorphous carbon (paragraph 0024). Liu et al. also discusses freeing more ends of nanotubes by this procedure because the tips of the

invention contribute to a decreased threshold voltage required for field emission (paragraph 0026).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Uemura et al. and Shin et al. to include using a laser to make the nanotube surface more uniform instead of an electric field as taught by Liu et al. in order to remove byproducts on the nanotube film surface and make a smoother surface. In addition, it would be obvious to one of ordinary skill in the art that when the nanofiber with both ends attached to the substrate of Uemura et al. and Shin et al. is irradiated with the laser as taught by Liu et al. to free the ends of the nanotubes, more nanotubes would be created as one nanotube connected at both ends when irradiated will become two nanotubes each connected at one end. Because the nanofibers were curled in Uemura et al. to begin with as described above, the separated nanofibers will also be curled.

Regarding claims 2-4, Uemura et al. discloses the nanotubes as carbon (paragraph 0024) the substrate as iron (paragraph 0045) and the nanotubes formed by thermal chemical vapor deposition (paragraph 0049).

Regarding claims 5-7, Liu et al. discloses the laser as an excimer laser with energy density of  $300 \text{ mJ/cm}^2$  and used in air at less than 1 standard atmospheric pressure (paragraph 0024).

***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kelly Stouffer whose telephone number is (571) 272-2668. The examiner can normally be reached on Monday - Thursday 7:00-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.


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Kelly Stouffer  
Examiner  
Art Unit 1792

kms

  
**TIMOTHY MEEKS**  
**SUPERVISORY PATENT EXAMINER**